

Cloud Computing

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Cloud:- Network

refers to the "servers" that are accessed over the internet (Present at remote location)

In simple terms

It means storing, managing and accessing the data and programs on the remote servers, that are hosted on internet instead of computers hard drive

or

Cloud computing is the on-demand availability of computer system resources.

(especially data storage/cloud storage and computing power) without direct active management by the user

In short:

We store, manage and process data on remote servers

* Service Providers

- Google cloud
- AWS (Amazon Web Servers)
- Microsoft Azure
- IBM cloud
- Alibaba cloud

* Types of cloud

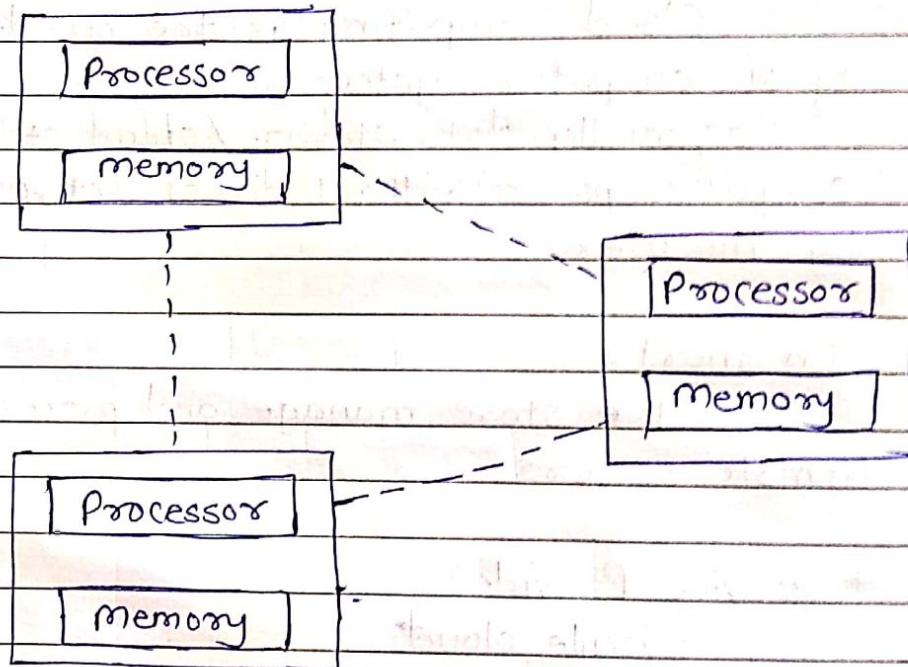
- 1) Public → Accessible to all
- 2) Private → servers accessible within an org.
- 3) Hybrid → Public + Private cloud features.
- 4) Community → servers Accessible by a group of organizations.

what are the computing paradigms are there?

1. Distributed computing:-

Type of computing where multiple computer systems work on a single problem

- Here all the computer systems are linked together and the problem is divided into sub-problems where each part is solved by different computer system
- The goal of distributed computing is to increase the performance and efficiency of the system and ensure fault tolerance

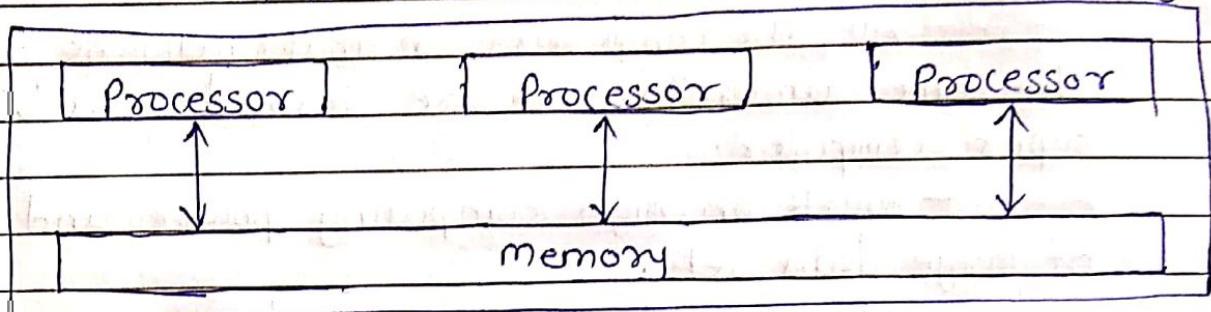


2. Parallel Computing:-

- Type of computing where multiple computer systems work on a single problem. Here all the computer systems are linked together are used simultaneously
- Problem is broken into sub-problems and then further broken down into instructions
- These instructions from each sub-problem are executed concurrently on different processors

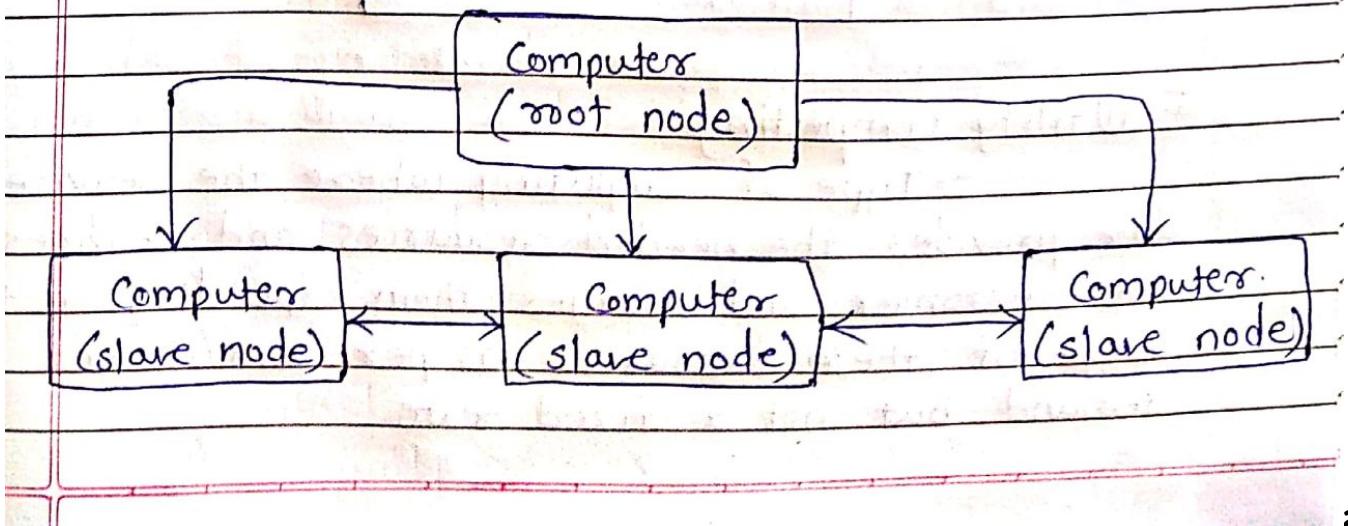
- How parallel computing system consist of multiple processors that communicate with each other and perform multiple tasks over a shared memory simultaneously

- Goal is to save time & provide concurrency.



3. Cluster Computing :-

- Group of independent computers that work together to perform the tasks given
- Cluster computing is type of computing that consist of two or more independent computers, referred to as nodes, that work together to execute tasks as a single machine
- Goal of this is to increase performance, scalability and simplicity of system
- below all the nodes acts as a single entity to perform the tasks.



4. Grid computing :-

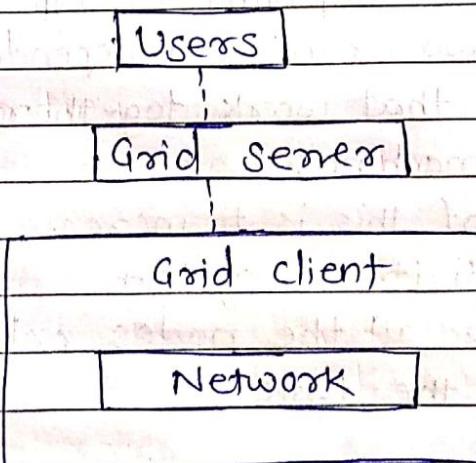
- Type of computing where it constitutes a network of computers that work together to perform tasks that may be difficult for a single machine to handle

- All the computers on that network work under the same umbrella and are termed as a virtual super computer.

- Work on high computing power and consist of large data sets.

- All communication bet' the computer systems in grid computing is done on the "data grid"

- The goal of grid computing is to solve more high computational problems in less time and improve productivity

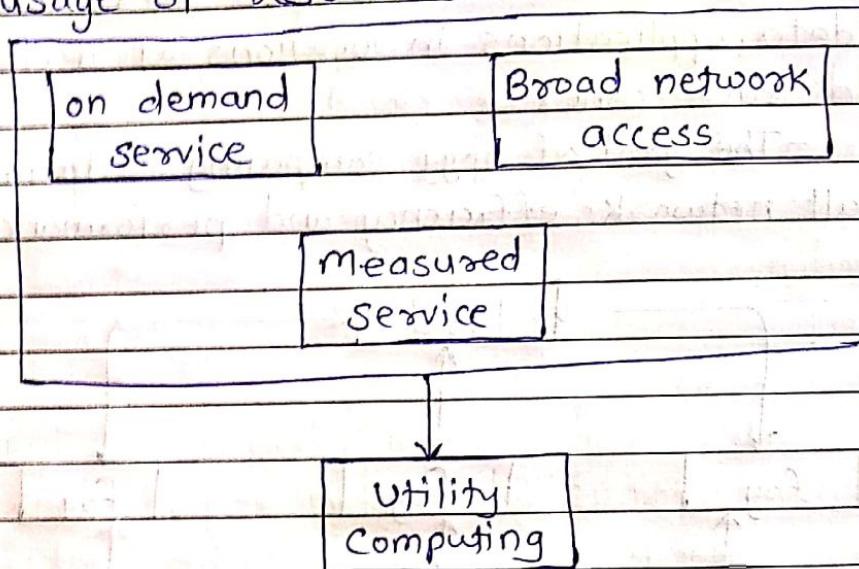


5. Utility Computing:-

- Type of computing where the service provider provides the needed resources and services to the customer and charges them depending on the usage of these resources as per recruitment and demand but not a fixed rate.

- It involves the renting of resources such as hardware, software, etc. depending on the demand and the requirement

- The goal of utility computing is to increase the usage of resources and be more cost-efficient

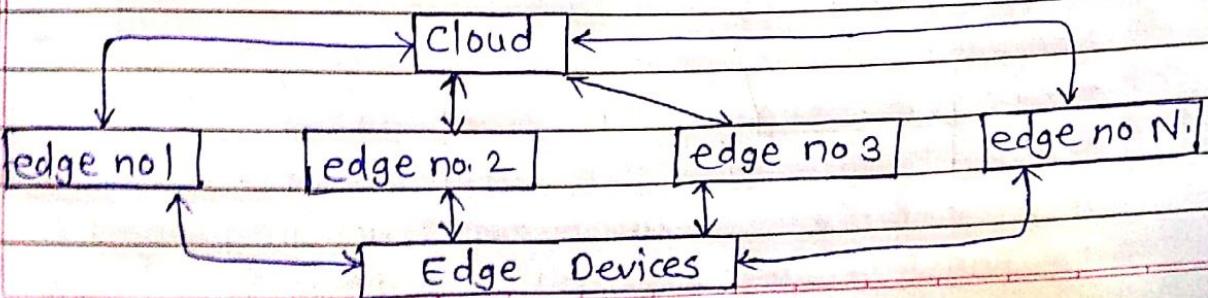


6. Edge Computing :-

- Type of computing that is focused on decreasing the long distance communication bet'n the client and the server.

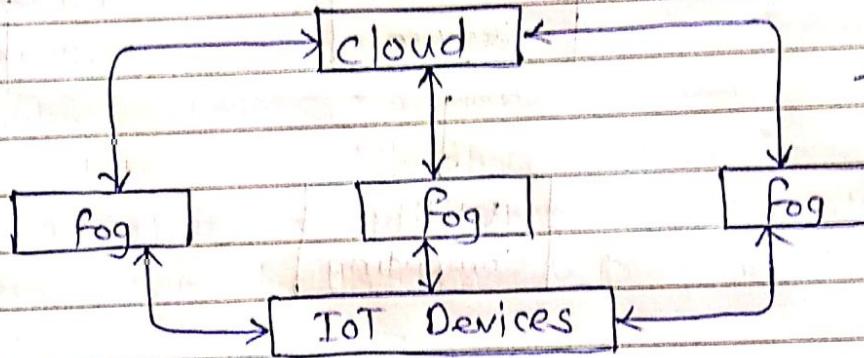
- Done by running fewer processes in the cloud and moving these processes onto a user's computer IoT device or edge device/server.

- The goal of edge computing is to bring computation to the networks edge which in turn builds less gap and results in better and closer interaction.



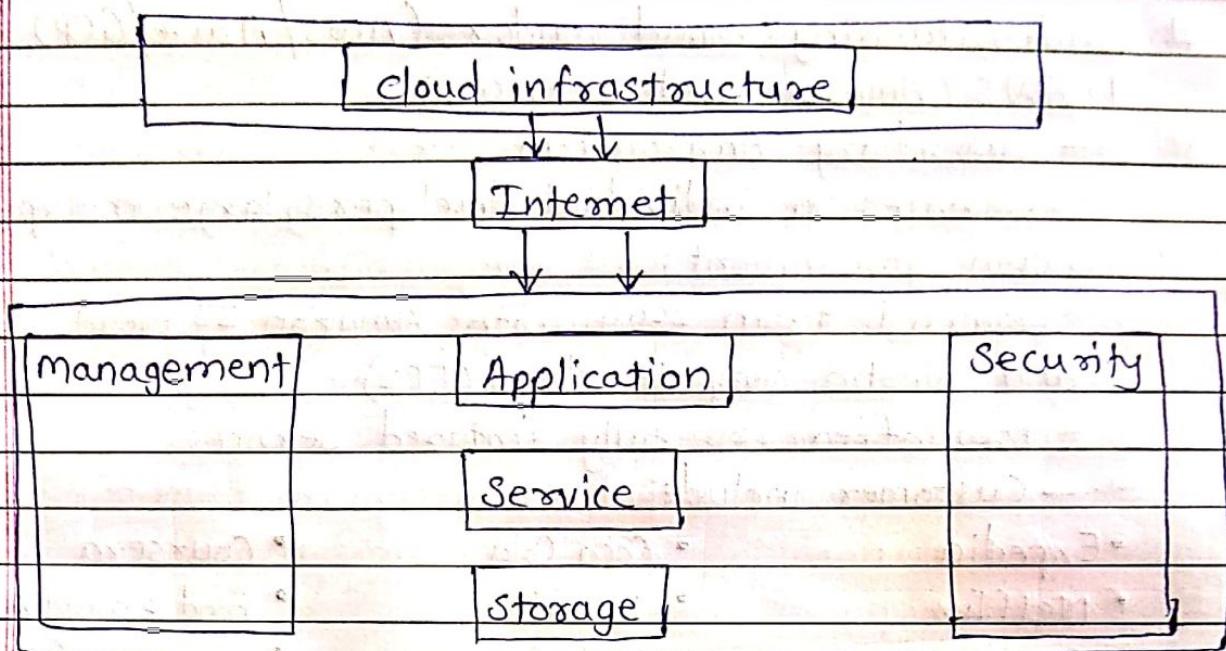
7. Fog Computing :-

- Type of computing that acts a computational structure betn the cloud and the data producing device. It is also called as "Fogging".
- The structures enables users to allocate resources, data, applications in locations at a closer range within each other.
- The goal of fog computing is to improve the overall network efficiency and performance.



8. Cloud Computing :-

- Usage of someone else's server to host, process or store data.
- Type of computing where it is the delivery of on-demand computing services over the internet on a pay-as-you-go basis. It is widely distributed, network-based and used for storage.
- clouds are public, private, hybrid and community and some cloud providers are google, AWS, Azure.



Characteristics and benefits : (Advantages)

- Ch- 1. On-demand self services
 2. Broad network access.
 3. Rapid Elasticity
 4. Resource pooling
 5. Measured service

Be/Ad :- 1. cost savings

2. Security
3. flexibility
4. mobility
5. Insight

6. Increased Collaboration

7. Quality Control

8. Disaster Recovery

9. Loss Prevention

10. Automatic Software Updates.

11. Competitive edge

12. Sustainability

Understanding cloud vendors (AWS/Azure/GCP)

1. AWS (Amazon web services)

- Subsidiary Amazon.com
 - Services to individual developers, large enterprises and even governments
 - started from 2006 with Amazon S3 cloud storage and elastic compute cloud (EC2).
 - now offer 200 fully featured services
 - customer include:
- | | | |
|------------|-------------|----------------------------|
| • Expedia | • Coca Cola | • Coursera |
| • Netflix | • Intuit | • Food & drug Administrat- |
| • Coinbase | • Airbnb | (FDA) |
| • Formula1 | • Lyft | • |

- AWS has 25 geographic regions with 81 availability zones . 218+ edge locations & 12 regional edge caches.

2. Microsoft Azure

- started from 2010 evolved in more than 200+ product and services
- provide wide array of services tailored in microsoft centric enterprises.
- making switch to a cloud or a hybrid cloud environment smooth for many organizations
- It is not limited to windows based services.
- It also supports open source language, technologies and platforms, giving anyone the freedom to build and support any application.

- | | |
|-----------------------------|-------------|
| • Daimler AG | • HSBC |
| • McKesson Group | • Starbucks |
| • Asos | • Walgreens |
| • Center of disease control | • BM |
| • National health service | • HP |

- Mitsubishi Electric
- Renault
 - runs 60+ regions with a minimum of 3 Availability zones in each region with more than 116 edge locations

3. Google Cloud Platform (GCP)

- GCP is cloud offering by none other than google.
- Part of overarchiving google cloud.
- started from 2010 the google cloud platform currently offers 100+ services spanning, computing, networking, big data and more.
- Services google workspace, Enterprise Android & chrome OS.
- It offers robust set of cloud services to power support any kind of application.
- Toyota
- Spotify
- Twitter
- Unilever
- The home Depot
- Paypal
- Nintendo
- Target
- UPS
- has 27 cloud regions with 82 zones and 146 edge locations.

Definition: cloud computing

It is delivery of difference service through the internet. These resources includes tools and applications like data storage, servers, databases, networking and software.

Cloud vendors:- It is company that delivers cloud computing based services and solutions to businesses and/or individuals. This organization may provide rented and provider-managed virtual hardware,

software, infrastructure and other related services.

II Characteristics of cloud vendor:-

1. Resources Pooling - Resource pooling one of the essential characteristics of cloud computing.
2. On-Demand self service. It is one of the significant and essential features of cloud computing.
3. Easy maintenance
4. Scalability And Rapid Elasticity
5. Automation
6. Resiliency and Availability
7. Economical
8. measured and reporting service
9. Security
10. large Network Access
11. Work from Any location
12. Multi-Tenancy
13. Flexibility
14. Service excellence.
15. Comfortable payment structure

II Components of cloud vendors

- A cloud service provider, or CSP is a company that offers components of cloud computing - typically, Infrastructure as a service (IaaS), software as a service (SaaS) or platform as a service (PaaS)

II Introduction to SaaS

- It is Software as a Service.
- SaaS is becoming very common and businesses are reaping the benefits. These applications have many advantages over traditional software packages, including

ease of use, lower costs, improved customer service and minimal upkeep.

- It also provides no burden on user, vendor accountability.

- SaaS is a way of delivering software applications over the internet, instead of physically installing and maintaining the software on-site, either on a server or right on your personal workstation.

- SaaS can also be referred to as hosted, on-demand or web-based software.

Pros and Cons of SaaS model :-

* Pros of SaaS

1. Lower Capital Expenditure (CAPEX)
2. Accessibility
3. Scalability
4. Saved maintenance cost
5. Ease of Deployment

* Cons of SaaS

1. Control Issues
2. Connectivity Issues
3. Security Issues
4. Service Level Agreement (SLA) Issues

Traditional Packaged software Vs SaaS

Traditional

SaaS

- One time fee
- Subscription free
- Free trial not available
- Free trial often available
- Installment required
- Installment not required
- Some updates are automatic
- All updates are automatic

- less likely has supplemental apps
- A new version is a new purchase
- mobile synchronization requires
- Additional software, often costly
- delivered over the internet
- many-to-many relationship
- most likely has supplemental apps
- A new version may be a new purchase
- mobile synchronization may require additional software often free or affordable
- sold in retail stores
- one-to-many relationship

SaaS examples:-

- BigCommerce
- Google Apps
- Salesforce
- Dropbox
- MailChimp
- Zendesk
- DocuSign
- Slack
- Hubspot

What is IaaS?

Infrastructure as a service is a form of cloud computing that delivers fundamental compute, network, and storage resources to consumers on-demand, over the internet and on a pay-as-you-go basis.

- IaaS enables end users to scale and shrink resources on an as-needed basis, reducing the need for high, up-front capital expenditures or unnecessary "owned" infrastructure, especially in the case of "spiky" workloads.

Examples of IaaS

- Digital Ocean
- Linode.
- Rackspace
- Amazon Web Services (AWS)
- Cisco metacloud
- Microsoft azure
- Google Compute Engine (GCE)

Introduction to virtualization:-

- Virtualization is a technique to divide the computer resources logically. It's achieved by abstracting away the underlying complexity of resource segregation.
- Although an old technology. It's still a popular technique and highly relevant in this era of cloud computing.
- Virtualization helps us to create software-based or virtual versions of a computer resource. These computer resources can include computing devices, storage, networks, servers or even application.
- It allows organizations to partition a single physical computer or server into several virtual machines (VM).

Types of Virtualization:-

1. Desktop virtualization -

- Creating virtual desktop infrastructure or VDI makes it possible to work and store files in locations that everyone in your team can easily access no matter where they work.

- Desktop virtualization allows people to access multiple applications and operating system on a single computer because the application and OS are installed on virtual machines that run on a server in the data center.

- There are two main method :-

1. Local desktop virtualization :-

It has many limitations, including the inability to use a mobile device to access the network resources.

2. Remote desktop virtualization :-

It is more robust and popular in the market place, with users running operating systems and applications accessed from a server located inside a secure data center.

2. Application Virtualization :-

- Through this users can access a remote version of an application that isn't installed on their individual machine.

- When virtualized, apps work in what is called a sandbox environment that runs separately from the OS. While operating in this sandbox, any changes will appear to run in the operating system, through the app is pulling operating power from the sand box.

- There are two kind of AV

a. Remote :- Application run on a server that mimics the user desktop and can be accessed by authorized users regardless of their location

b. Streaming :- Apps run just one instance on the server and provide local access to the app.

Virtual Machine
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3. Server Virtualization:-

- It allows for a better division of resources as it lets the administrator divide one physical server into multiple virtual servers.
- These virtual servers can be used to run a distinct operating system and any application needed.
- Businesses can decrease operational costs while enjoying faster deployment times and better application performance.

4. Storage virtualization :-

- Instead of physical storage space, virtual storage uses software to store the data in the cloud.
- All of the company storage disk arrays are placed in the virtual pool, made into virtual disks sent to the host servers for storage.
- With the data remotely stored, you can pull from any of the virtual storage sources within the data center and group them together.
- There are two types.

a. Internal :- available within vendor software

b. External :- where data can pulled or stored with few limitations.

5. Network Virtualization :-

- Network virtualization blends the physical and virtual network.
- It disconnects the virtual network from the physical hardware, making it possible to use switches.

to direct network traffic and manage resources through traffic surges

Uses:-

1. slash your IT expenses
2. Reduce downtime & enhance resiliency in disaster recovery situations
3. Increase efficiency and productivity
4. Control independence and devOps.
5. move to be more green-friendly (organizational & environmental)

Virtual Machine Provisioning :-

- Virtual machine provisioning or virtual server provisioning, is a system management process that creates a new virtual machine (vm) on a physical host server and allocates computing resources to support the vm.

- Virtual provisioning is a virtual storage network (vSAN)- based technology in which storage space is allocated on demand to devices. This process allows virtualized environments to control the allocation and management of physical disk storage connected with vm.

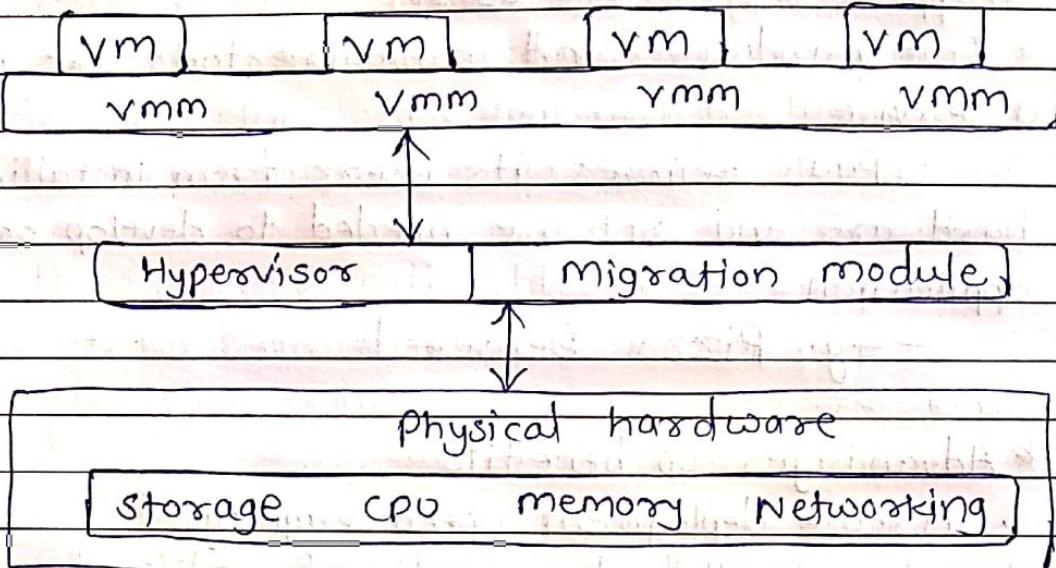
- Thin provisioning is more relevant to physical computing implementation.

Virtual machine migration services

- Virtual machine migration is the task of moving a virtual machine from one physical hardware environment to another. It is part of managing hardware

Virtualization systems and is something that providers look at as they offer virtualization services.

- Virtual machine migration is also known as teleportation.



Migration - Virtual Architecture

Private cloud computing Deployment

- A private cloud refers to a cloud deployment model operated exclusively for a single organization, whether it is physically located at the company's on-site data center, or is managed and hosted by a 3rd party provider.

- here resources are not shared with other organizations but this also means that the company using it is entirely responsible for its management, maintenance and regular updates which can also get significantly more expensive than public ones.

- Advantages:- more possibilities

- higher security

- Enhanced reliability

Introduction to PaaS

- A cloud computing model which allows user to deliver applications over the Internet. In this model, a cloud provider provides hardware as well as software tools which are usually needed for development of required applications to its users.
- hardware and software tools are provided as a service
- PaaS relieves its users from installing in house hardware and software needed to develop or run a new application
- e.g. Pizza Delivered.

* Advantages or benefits:-

1. increase deployment speed & agility
2. Reduce length and complexity of app lifecycle
3. Prevent loss in revenue.
4. Automate provisioning, management and auto-scaling of applications and services on IaaS platform
5. Support continuous delivery
6. Reduce infrastructure operation cost
7. Automation of admin staff tasks

Storage as a Service (RAID)

- RAID stands for redundant array of independent disks. RAID storage uses different disks to provide fault tolerance, to improve overall performance and to increase storage size in a system.
- This is in comparison with older storage devices that used only a single disk drive to store data
- RAID storage provides a limited number of IOPS, speed and storage according to the disk type you are

choosing

- we hit bottleneck if our IOPS needs increases or if we need more speed or redundancy
- it will provide both speed and disk fault tolerance

challenges of cloud environment

1. Data security and privacy
2. Cost management
3. multi-cloud environments
4. Performance challenges
5. Interoperability and flexibility
6. High dependence on network
7. Lack of knowledge and expertise

Hypervisor :-

A hypervisor, also known as a virtual machine monitor or vmm, is software that creates and runs virtual machines (vms). A hypervisor allows one host computer to support multiple guest vms by virtually sharing its resources, such as memory and processing.

* Benefits of hypervisor:-

1. speed
2. efficiency
3. flexibility
4. Portability

Organizational Scenarios of clouds :-

- End user to cloud

Data is managed in cloud. End user does not need to be keep up with anything other than password

e.g. Email application.

- The cloud services must Authenticate users.
- Cloud vendors should be very clear about service level agreements (SLAs)
- Access to cloud should not require a particular platform or technology (open client)
- Enterprise to cloud to end user
when end user interacts with enterprise, Enterprise accesses data from cloud manipulates it and sends to end user.
- Enterprise to cloud

Enterprise using cloud services for its internal processes.

- Enterprise to cloud to enterprise

Two enterprise using same cloud

- Private cloud

Useful for larger enterprises

- Hybrid clouds

Both public and private clouds work together.

* Benefits :- Same as before characteristic

Administering & Monitoring cloud services

- Cloud monitoring is method of reviewing, observing and managing the operational workflow in a cloud based IT infrastructure.

- Manual or automated management techniques confirm the availability and performance of websites, servers, applications and other cloud infrastructure

- This continuous evaluation of resource levels, server response times and speed predicts possible vulnerability

to future issues before they arise.

- cloud monitoring is primarily part of cloud security and management processes. It is normally implemented through automated monitoring software that provides central access and control over cloud infrastructure.

* Types of cloud monitoring

1. Database monitoring
2. Website monitoring
3. Virtual network monitoring
4. Cloud storage monitoring
5. Virtual machine monitoring

Advantages of cloud monitoring

- Ease of access to information
- Access from several stations simultaneously and from anywhere
- The information is structured in such a way as to be easily exploitable
- All relevant data from all applied predictive techniques and technologies are brought together in a single platform
- They cost less than a local application.
- It offers greater security
- Performance optimisation.

Comparison among SaaS, PaaS, IaaS

⇒ See before articles on that : SaaS, PaaS, IaaS

Cloud computing basics

⇒ see in cloud & types of computing

Cloud Products and Solutions

cloud products:-

- compute
- storage
- databases
- analytics
- networking
- mobile
- developer tools
- management tools
- IoT
- Security
- Enterprise applications

cloud solutions:-

1. Industry solutions
2. Financial services
3. Government and public sector
4. Application modernization
5. Artificial intelligence
6. APTs and applications
7. Databases
8. Data cloud
9. Digital transformation.
10. Infrastructure modernization
11. Productivity and collaboration.
12. Security
13. Smart analytics
14. Startup & SMB

Cloud pricing:-

1. Start running workloads for free
2. Only pay for what you use

3. Save upto 57% on workload (with discount)
4. Stay in control of your spending
5. Estimate your costs

Compute products & services:

1. Application migration
2. SAP on Google Cloud
3. Microsoft and windows on Google Cloud
4. Instances (vm)
5. Containers
6. Serverless
7. Edge and hybrid
8. Cost and capacity management

Elastic cloud compute

Amazon EC2 (Elastic Compute Cloud) is a web service interface that provides resizable compute capacity in the AWS cloud. It is designed for developers to have complete control over web-scaling & computing resources.

- Instances scaled up or down as per requirement.
- it can be launched one or more graphical location or regions & Availability Zones (AZs)

EC2 Components:

- operating system support
- Security measures
- Pricing structures
- fault tolerance
- migration

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Features of EC2

- Reliable
- Designated for Amazon web services
- Secure
- Flexible tools
- Inexpensive

Dashboard

A cloud dashboard is a dashboard that is dashboard that you can build and access on a web browser.

- It has key advantages over on-premise software such as being easier to deploy, requiring little to no IT support and is accessible on multiple devices.
- It includes in dashboard monitoring

Launching Linux VM

Accessing Linux VM

Launching and Accessing Windows Server VM

⇒ we all do this in Lab session successfully.